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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/647,696	08/25/2003	Mohan Kirloskar	50626.54	2471

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EXAMINER	
BEREZNY, NEMA O	
ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 11/15/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/647,696	KIRLOSKAR ET AL.	
	Examiner	Art Unit	
	Nema O Berezny	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 September 2004*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *25 August 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *09202004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

This Office Action is in response to Applicant's Amendment/Response filed 9-20-04, which has been entered and considered. Claims 1 and 3-24 are currently pending; cancellation of claims 2 and 25-30 is acknowledged.

Claim Objections

The objection to claim 6 in prior Office Action is hereby withdrawn, subsequent to corrections made by Applicant in Amendment filed 9-20-04.

Claim Rejections - 35 USC § 112

The rejection of claims 13 and 24 under 35 USC 112 second paragraph, made in prior Office Action is hereby withdrawn, subsequent to corrections made by Applicant in Amendment filed 9-20-04.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1 and 4-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Atwood et al. (6,656,770) in view of Tonti et al. (5,773,362), and further in view of Sono et al. (5,444,025). Atwood discloses a process for manufacturing an integrated

circuit package or a plurality of integrated circuit packages comprising: mounting a semiconductor die or dice (Fig.1 el.12), to a first surface of a substrate or substrate array (el.10) such that bumps (el.11) on said semiconductor die or dice are electrically connected to conductive traces (inherent) of said substrate; mounting a collapsible spacer or spacer array (el. 18) to at least one of a heat spreader or heat spreader array (el.14), said semiconductor die and said substrate or substrate array (col.11 lines 47-64); fixing said heat spreader to at least one of said first surface of said substrate and said semiconductor die such that said at least one collapsible spacer is disposed therebetween (Fig.1); forming a ball grid array or a plurality of ball grid arrays (no #) on a second surface of said substrate, bumps of said ball grid array being electrically connected to said conductive traces (inherent). However, Atwood does not disclose singulating said package or packages. Atwood would look to one such as Tonti for more efficient IC fabrication because Tonti discloses singulating said integrated circuit package (col.1 lines 43-64). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of invention to use the singulating of Tonti with the process of Atwood in order to mass fabricate a large number of packages in a single process step, thereby saving time and costs. Atwood in view of Tonti do not disclose molding said die, said substrate, said collapsible spacer, and said heat spreader in a molding compound. Atwood and Tonti would look to one such as Sono for device protection because Sono discloses wherein fixing said heat spreader comprises: placing one of said heat spreader and said substrate in a mold cavity (Fig.313); releasably clamping the other of said heat spreader and said substrate to a die of said mold cavity,

such that said collapsible spacer is disposed between said heat spreader and said substrate (col.4 lines 16-20); and molding a molding compound in the mold, thereby molding the semiconductor die, the substrate, said at least one collapsible spacer, and said heat spreader into the molding compound to provide a molded package (Fig.6 el.7). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the molding of Sono with the process of Atwood in view of Tonti in order to protect the device from moisture, and chemical and mechanical stress; and to provide highly accurate placement of the heatsink (col.4 lines 25-30) **[claims 1, 15].**

Based upon the rejection of claim 1 above, Atwood also discloses wherein fixing said heat spreader comprises reflowing of the at least one collapsible spacer (col.11 lines 24-30) **[claim 4];** wherein said mounting a semiconductor die comprises mounting said semiconductor die in a flip-chip orientation, to said substrate (Fig.1) **[claim 5];** wherein said mounting said semiconductor die comprises solder reflowing thereby connecting said bumps of said semiconductor die in said flip-chip orientation to said conductive traces of said substrate (col.9 lines 41-42) **[claim 6];** wherein said mounting further comprises underfilling said semiconductor die (Fig.3) **[claim 7];** wherein said mounting at least one collapsible spacer comprises mounting said at least one collapsible spacer to said substrate (Fig.1; col.9 lines 53-54) **[claim 10];** wherein said mounting at least one collapsible spacer comprises mounting said at least one collapsible spacer to said heat spreader (Fig.1) **[claim 11];** and wherein said at least

one collapsible spacer comprises a plurality of collapsible spacers, and mounting said at least one collapsible spacer comprises mounting one of said plurality of collapsible spacers to said semiconductor die and mounting at least another of said collapsible spacers to said substrate (Fig.1**) [claim 12].**

Based upon the rejection of claims 1 and 15 above, Atwood and Tonti would look to one such as Sono for accurate mold placement because Sono discloses wherein said placing one of said heat spreader and said substrate in a mold cavity comprises placing said heat spreader in said mold cavity such that said heat spreader rests on a lower die of said mold and said releasably clamping comprises releasably clamping said substrate to an upper die of said mold (Figs.3A-3E). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the molding of Sono with the process of Atwood in view of Tonti in order to accurately place and secure each device element in the molds from movement; wherein the top and bottom dies are only relative to each other **[claims 8, 9, 19, 20].**

Based upon the rejection of claims 1-2, 8-9, and 12 above, Atwood discloses wherein said at least another of said collapsible spacers is disposed in contact with said heat spreader during molding (Fig.1) **[claims 13, 14].**

Based upon the rejection of claim 15 above, wherein said mounting semiconductor dice comprises mounting said semiconductor dice in a flip-chip

orientation, to said substrate array (Fig.1) **[claim 16];** wherein said mounting said semiconductor dice comprises solder reflowing thereby connecting said bumps of said semiconductor dice in said flip-chip orientation to said conductive traces of said substrate array (col.9 lines 41-42) **[claim 17];** wherein said mounting further comprises underfilling said semiconductor dice (Fig.3) **[claim 18];** wherein said mounting said spacer array comprises mounting said collapsible spacer array to said substrate array (Fig.1; col.9 lines 53-54) **[claim 21];** wherein said mounting said collapsible spacer array comprises mounting said collapsible spacer array to said heat spreader array (Fig.1) **[claim 22];** wherein mounting said collapsible spacer array further comprises mounting a corresponding collapsible spacer of said collapsible spacer array to each of said plurality of semiconductor dice (Fig.1) **[claim 23];** and wherein said collapsible spacer array is disposed between and in contact with said heat spreader during molding (Fig.1) **[claim 24].**

Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Atwood in view of Tonti and Sono as applied to claim 1 above, and further in view of Huang et al. (2002/0180035). Atwood in view of Tonti and Sono do not disclose thermally curing said collapsible spacer. Atwood, Tonti and Sono would look to one such as Huang for thermal conductivity because Huang discloses wherein fixing said heat spreader comprises thermal curing of the at least one collapsible spacer (Fig.1 el.26; p.3 para.35). Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to use the thermal curing of Huang with the process of

Atwood in view of Tonti and Sono in order to provide a spacer between the chip and heat spreader that is electrically isolated but still thermally conductive.

Response to Arguments

Applicant's arguments filed 9-20-04 have been fully considered but they are not persuasive. Claim 1 has been amended to include the limitations of old claim 2; therefore, these responses to arguments will pertain to new claim 1 and claims 15-24.

Applicant contends that neither Atwood nor Tonti disclose the steps of "placing one of said heat spreader ...", "releasably clamping ...", and "molding ...". Both the instant and prior rejections cite Sono as disclosing these steps.

Applicant also contends that Sono does not disclose the above steps of placing, releasably clamping, and molding. Examiner disagrees. As cited in the prior and instant rejections, these steps are disclosed by Sono in Fig.3B, Fig.6, and col.4 lines 16-20. The claim requirement of said collapsible spacer being disposed between the heat spreader and the substrate is disclosed by Atwood, as cited in the prior and instant rejections.

Applicant also contends that Sono fails to teach or suggest mounting the die to a substrate because Sono fails to teach or suggest the use of any substrate, and mounts the die directly to the radiator block. Examiner disagrees. Firstly, Atwood teaches the use of a substrate as cited in the prior and instant rejections. Secondly, Sono does teach the use of a substrate in Fig.5C (el.33) and in Fig.5D (el.35). Examiner did not

cite nor intend for the substrate 100 in Fig.6 of Sono to be used to fulfill the claim requirement for a substrate, as suggested by Applicant.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nema O Berezny whose telephone number is (571) 272-1686. The examiner can normally be reached on M-F 9-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

NB

CARL WHITEHEAD, JR.
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